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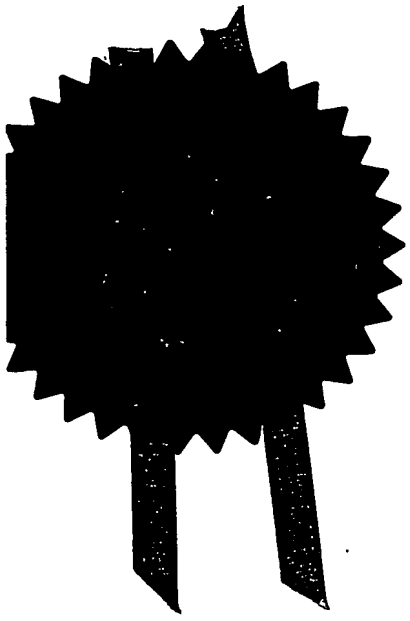

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Dated 2 November 2004

ents Form 1/77

Patents Act 1977
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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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1. Your reference ~~P18257GB JCC/lp~~ NAM/P71341GB00

2. Patent application number *(The Patent Office will fill this part in)* 05 NOV 2003 0325849.8

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Microsharp Corporation Limited,
52 Shrivenham Hundred Business Park,
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United Kingdom

07508922002
Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention REAR PROJECTION SCREEN, AND REAR PROJECTION SYSTEM USING THE SCREEN

5. Name of your agent *(if you have one)*

~~Forrester Ketley & Co.~~

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

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Patents ADP number *(if you know it)* ~~133001~~ 42001 (5/77 dlp 15/3b

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application	Date of filing *(day / month / year)*

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?

Answer YES if:

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.

Otherwise answer NO (See note d)

9. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form	
Description	10
Claim(s)	17
Abstract	0
Drawing(s)	12 + 12

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	
Request for a preliminary examination and search (Patents Form 9/77)	
Request for a substantive examination (Patents Form 10/77)	
Any other documents (please specify)	

11. I/We request the grant of a patent on the basis of this application.

Signature(s) Forrester Ketley & Co. Date 5 November 2003

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

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Notes

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Title: Rear Projection Screen, and Rear Projection System using the screen

Field of the Invention

THIS INVENTION relates to a rear projection video system such as may form part of a rear projection television system. The invention also relates to an optical panel which is particularly, but not exclusively, useful as a rear projection screen for such a rear projection video system, for example in a slim television receiver and which can achieve high transmission efficiency and high contrast.

Background of the Invention

Conventional rear projection systems include an image engine source, such as a projector, optics to enlarge and direct the image-forming light and a light-transmitting viewing screen upon which the image to be viewed is formed, and which typically comprises a light–diffusing layer or surface.

The depth dimension of rear projection systems is traditionally reduced by a set of mirrors that are designed to allow a relatively large, image to be presented to view in a cabinet which has a relatively small depth, i.e. dimension measured perpendicular to the viewing surface of the viewing screen.

Diverse configurations have been proposed in the past that use more or less efficiently the space of rear projection cabinet. U.S. Pat. No. 3,947,104 discloses a compact imaging apparatus which projects an image upwards using a series of two folding mirrors. U.S. Pat. No. 6,388,810 discloses a rear projection mirror arrangement that includes a curved shape mirror to produce a compact cabinet. Recently, more effort has been devoted to the development of

panel displays for improving the light transmission and uniformity of illumination. Fresnel lens arrangements are becoming commonly used as part of such systems for the collection of light and the enhancement of the overall display luminance uniformity. However, Fresnel lens arrangements, are subject to Moiré patterns and ghosting and these are drawbacks which can represent a serious limitation as indicated in U.S. Pat. No. 6,249,376. U.S. Pat. No. 2003/0058532 discloses a Fresnel lens that has a pitch including a hybrid prism comprising a refraction prism unit and a total internal reflection prism unit. The width ratio of the refraction and the total internal reflection blade in a pitch is changed gradually as the incidence angle increases.

Summary of the Invention

It is among the objects of the present invention to provide an improved optical panel to provide an improved optical panel and an improved rear projection system incorporating such a panel.

According to one aspect of the present invention, there is provided an optical panel, for use, for example in rear projection video systems, the panel comprising a transparent body having a rear surface characterised by a plurality of ribs and grooves, each said rib including a transparent face on one side of the rib and an internally reflective face on the opposite side of the rib, such that light, for example from a projection system, directed obliquely with respect to the panel so as to pass through said transparent face towards the adjoining internally reflective face will be reflected by the latter face to pass through said transparent body towards the front surface of said panel.

According to another aspect of the present invention, there is provided a rear projection video system incorporating an optical panel according to the first noted aspect.

In a rear projection television receiver utilising the invention, to reduce the depth of the rear projection cabinet, the image light engine, such as a projector, is placed to one side of (typically below), and close to the projection screen so that the angles of incidence of light from the image light engine onto the screen are increased to the extent that the light is nearly parallel to the planes of front surface of the screen as it strikes the rear face of the screen. The depth of a rear projection television cabinet is dictated by the angle of incidence on the rear face of the screen system, so that the depth of the cabinet can be made small.

A preferred embodiment of the present invention provides a rear projection screen that achieves high transmission efficiency and provides high contrast across the screen for an oblique incident light beam. The rear face of the screen comprises a prismatic structure, for example a structure comprising a series of lenticular prisms incorporating one or more sides, also referred to herein as faces, facets or sections. In some embodiments, one or more said faces of a said prism may be curved. The curved side of the lenticular prism acts as a light concentrator to focus light in order to enhance the contrast. The front face of the screen in some embodiments comprises an array of lenticular lens elements combined with back stripes to absorb the ambient light. In operation, the image light received from an image engine or projector is transmitted by one side of each lenticular prism and undergoes total internal reflection at one or more further sides of the prism so that the light is redirected to the front of the screen and thus towards the viewing space.

Embodiments of the invention are described below with reference to the accompanying drawings wherein:-

Figure 1 is a schematic isometric view illustrating a rear projection system in accordance with the invention,

Figure 2 is a view in cross-section, to an enlarged scale, through the optical panel or screen of the system,

Figure 3 is a view corresponding to Figure 2 but illustrating the redirection of the image light beams by total internal reflection,

Figure 4 is an enlarged view in section showing the structure of one form of the screen, illustrating the focusing effect,

Figure 5 is an isometric view showing the horizontal and vertical viewing angle of the screen,

Figure 6 is a sectional view of the screen illustrating the redirection and diffusion of the image light beam using a diffuser instead of cylindrical lens elements,

Figure 7 is a view similar to Figure 3 but illustrating an embodiment incorporating black stripes for contrast enhancement at the rear face of the screen,

Figure 8 shows, in perspective, an optical panel according to the invention in combination with a lenticular lens sheet,

Figures 9, 10 and 12 are views similar to Figure 4 but illustrating the focusing and the redirection of an image light beam by total internal reflection in respect of optical panels or screens of different configurations, and

Figure 11 is a view similar to Figure 6 illustrating the redirection and diffusion of the image light beam using a diffuser, instead of cylindrical lenses, in an arrangement in which faces of ribs on the rear of the optical element have a focusing effect.

Figure 1 shows, by way of non-limiting example, an isometric view illustrating schematically a rear projection system comprising an optical display panel 20 in accordance with the invention and means 18 for projecting image-forming light 19 obliquely onto a rear surface of the panel 20. In the arrangement shown, the means 18 comprises a light source 18c, a light modulator 18b, and imaging optics 18a which direct light, from light source 18c, after modulation by modulator 18b, onto the rear of panel 20, to pass through the front of the panel and produce, at the front of the panel or viewing screen, an image 3 for viewing by an observer 30 located in front of the panel. The imaging optics 18a distribute the image light 19 horizontally and vertically over the back side of the panel 21 for transmission therethrough. The imaging optics 18a, which may include folding mirrors and lenses, are optically aligned between the back face of the panel 21 and the light modulator 18b.

The projector 18 may be a conventional projector, with the light modulator taking the form of a slide or film, or may comprise an LCD panel with associated controlling electronics. The light source and modulator may be combined as a video (e.g. CRT) screen. Alternatively, the light source might comprise, for example, a laser, which may be arranged to effect a raster scan, with associated means for modulating the laser beam. The present invention allows the dimensions of the panel 20 to be of any desired magnitude, and the panel may be of a size to provide a large video display screen. The rear projection system may be the display system of slim, rear projection, television receiver.

The rear projection system can be housed in a slim, compact cabinet with the optical panel 20 forming the front face and viewing screen. It is envisaged that the housing or cabinet will include all working components.

The projector may be of any conventional form capable of projecting a viewable image. There are many types of modulator 18b which can be included in different embodiments of the invention. For example, different embodiments could include, singly or in any combination, any of the following:-
a conventional Liquid Crystal Display (LCD), a Digital Micromirror Device (DMD), a laser-raster scanner, a Microelectromechanical System (MEMS) technology, or a CRT.

Figures 2 and 3 illustrate to an enlarged scale the portion 5 of the optical display panel shown in Figure 1. INSERT 2A

The Panel 20 may be a rigid sheet of transparent glass or plastics, having a rear surface provided by a plurality of parallel ribs and grooves, the longitudinal extent of which runs generally perpendicular to the direction of the light rays passing to the rear surface of the panel from image projecting means. More particularly, the rear surface may have, in section perpendicular to the planes of major extent of panel 20, and perpendicular to the longitudinal extent of the ribs and grooves, a profile or waveform, as shown in Figure 2 or Figure 3, comprising a series of identical or similar elements each of which may be regarded as defining a respective rib, or lenticular prism, and an adjoining groove, each said element comprising a plurality of light segments, defined by respective faces or facets, (also referred to herein as sections), of the respective rib or groove. The ribs and grooves of the rear of panel 20 may be of constant cross-section throughout their length. In the arrangement shown, the projector 18 directs its light upwardly onto the back of panel 20 and the ribs and grooves on the back of the panel run horizontally.

Each rib on the rear surface of the panel 20 may include a transparent facet 10, which may be planar, or may be curved convexly to some extent in the preferred embodiment, the facet 10 extending almost perpendicular to the planes of major extent of the panel 20. More particularly, the facets 10 are substantially perpendicular to the direction of rays 19 (see Figs 3 and 4) of imaging light which strikes the rear surface of the panel 20 at a small angle ✔ with respect to the planes of major extent of the panel 20 . Thus, the rays of image light 19 are substantially perpendicular to the facet 10, which prevents the existence of ghost image light.

Referring again to Figures 2 and 3, each rib/groove element includes, extending from the rearmost limit of face 10, a face or section 11 which is optically non-functional and extends generally perpendicularly to face 10 and thus parallel with light rays 19, the face 11 extending to an internally reflective face or section 12 which lopes from the face 11 towards the front surface of the panel and terminates, in the arrangement of Figures 2 to 6, in the bottom of a groove, the opposite wall of which is formed by an optically non-functional face or section 13A extending rearwardly to a yet further face or section 13B which extends, generally parallel with the front surface of the panel 20, to the edge, nearest the front surface of panel 20, of the next rib/groove element. As shown in Figures 3, 4 and 6, light rays 19 passing into the panel 20 through the face 10 of such a rib/groove element are reflected, internally, i.e. within the panel, at the face 12 of that rib/groove element, to pass approximately perpendicular to the planes of major extent of the panel, (and thus approximately perpendicular to the front surface of the panel), through the panel 20 to exit through said front surface, towards the observer. In order to enhance contrast and minimise reflection of ambient light, the front surface of the panel 20 may be provided with a plurality of black stripes 15, one for each rib/groove element, extending parallel with the ribs and groove on the rear face of the panel 20.

The material that forms the optical display panel can be suitably selected to be transparent according to the application. The curvature of the facets 10 in the preferred embodiments controls the vertical viewing angle of the panel display, as shown in Figure 5, and concentrates or focuses the transmitted light 19 in the vertical direction to pass between the black stripes 15 over the front face of the optical display panel 20 to provide superior contrast. The black stripes 15 absorb the ambient light while the reflected image light 19a is transmitted between the stripes. The incident angle ✔ dictates the depth of the cabinet housing of the display system and in the present embodiment ✔ has an acute value. Preferably, ✔ has a value between 0 and 90 degrees, more preferably between 0 and 60 degrees, most preferably between 0 and 30 degrees. As noted, the facet 11 may be planar and parallel to the rays of the incident light 19. The facets 12 may also be convexly curved, for example of conical, elliptical, hyperbolic, or spherical shape, or may be planar. The facets 12 form a suitable angle with respect to facets 10 to reflect the transmitted light 19 towards the observer 30. The surface of each facet 12 may have a light reflecting coating for better reflection. The index of refraction of the environment medium is lower than the index of refraction of optical display panel 20, and the facets 12 may redirect the image light 19 by total internal reflection, without the need for a reflective coating, depending upon the specific refractive index and angle of incidence of light. The facets 13a and 13b, which do not intercept the light may have a curved or an arbitrary shape or may be planar.

Figures 4 and 6 (enlarged view) illustrate a lens focusing effect due to curvature of the facets 10. This effect may also be produced or enhanced by the focusing effect of curved facets 12. The image light is concentrated on the front face of display panel 20 and thereafter the light 19a passes to the observer. The light 19a may be spread or diffused in the horizontal and vertical directions to

increase the viewing angle accordingly, as shown in Figure 5, by various means. Thus, as shown in Figure 4, in each light transmitting band at the front of the screen, between adjoining black stripes 15, there may be disposed a row of lenses, which may be spherical or quasi-spherical convex lenses or may be cylindrical (lenticular) lenses as indicated at 14, with vertical axes of curvature. Alternatively, to achieve a wide angle of view vertically, each light transmitting band between adjoining black stripes 15 may be occupied by a respective lenticular lens with a horizontal axis of curvature and some other means may be used to provide the desired horizontal angle of view. For example a light diffuser 21 may extend across the front of the screen 20 to enlarge the horizontal viewing angle as illustrated in the embodiment in Figure 6.

The facets 13a and 13b may have an arbitrary shape and material, and indeed, as illustrated in Figure 7, these facets 13a and 13b may be replaced by or covered by black stripes 16 or may be coated with a suitable light-absorbing material or structure.

A lenticular lens sheet 40 that has vertically extending lenticular lenses 40a for horizontal spread or diffusion of light may be placed in front of the panel 20, as illustrated in Figure 8, to increase the field of view. The sheet 40 may include light absorbing structure 40b to enhance the contrast of the screen.

The embodiment of the optical panel 55 shown in Figures 9 and 10 comprises, on the rear of the panel 55, a repeating rib/groove element each of which comprises a transparent planar facet or section 50, which may be planar as shown in Figure 9 or may be convex, as shown in Figure 10, e.g. of conical, elliptical, hyperbolic or spherical shape. Each repeating rib/groove element in Figures 9 and 10 comprises an internally reflecting face 51 extending from the rearmost edge of face 50 to a further section 52, e.g. parallel with the front

surface of the panel, which extends from the forward edge of face 51 to the forward edge of the face 50 of the next rib/groove element. Again, the material that forms the optical display 55 can be suitably selected to be transparent according to the application. The rays of image light 19 are again substantially perpendicular to the facts 50, which ensures high transmittance and prevents the formation of ghost image light. The curvature of the facet 50 (Fig 10) controls the vertical viewing angle of the panel display 55, and concentrates the transmitted image light 19 in the vertical direction to pass the light 19a between the black stripes 53 which absorb the ambient light to provide and augment the contrast background. The facet 51 may be curved as shown in Figure 9 or may be planar as shown in Figure 10 and reflects the transmitted light 19 towards the observer by total internal reflection. The redirected light 19a is diffused in the horizontal direction to increase the viewing angle accordingly, as shown in Figures 9 and 10, by means of cylindrical lenticular lens 59 in the same way as described in relation to Figure 4 or by using a diffuser 60 to enlarge the vertical and horizontal viewing angle as illustrated in Figure 11.

The facet 52 may be planar and may be transparent or may also be coated with light-absorbing (e.g. black) material 61 as shown in Figure 12, to enhance the contrast of the display panel.

The examples given herein are presented to enable those skilled in the art to more clearly understand and practice the invention. The examples should not be considered as limitations upon the scope of the invention, but as merely illustrative. Numerous modifications and alternative embodiments of the invention will be apparent to those skilled in the art in view of the ongoing description and the following claims are intended to cover all such modifications and variations.

Claims

1. An optical panel, for use, for example in rear projection video systems, the panel comprising a transparent body having a rear surface characterised by a plurality of ribs and grooves, each said rib including a transparent face on one side of the rib and an internally reflective face on the opposite side of the rib, such that light, for example from a projection system, directed obliquely with respect to the panel so as to pass through said transparent face towards the adjoining internally reflective face will be reflected by the latter face to pass through said transparent body towards the front surface of said panel.

2. An optical panel for displaying projected light formed by a primary source arranged behind the optical panel, wherein the said optical panel comprises:

a back face having a transparent, substantially periodic structure comprising a series of groups of faces or sections;

each said group comprising;

a transparent first section or face for transmitting the said light,

a transparent second section or face adjoining said first section and substantially parallel to said light, and

a transparent third section or face adjoining said second section for effecting total internal reflection of said transmitted light, said third section being situated between said first section and said second section, and

a fourth section adjoining said third section to the adjacent said first section.

3. An optical panel for displaying a projected light formed by a primary source arranged behind the optical panel, which optical panel comprising:
a back face having a transparent substantially periodic structure constituted by a group of transparent facets;
a transparent first section for transmitting the said light, and
a transparent Second section adjoining said first section for effecting total internal reflection of said transmitted light situated between said first section and said second section, and
a third section adjoining said second section to the adjacent said first section.

4. The optical panel of claim 1, 2 or 3 wherein said first section is a focusing element.

5. The optical panel of claim 4, wherein said first section is a focusing element comprising at least one curved facet.

6. The optical panel of claim 4, wherein said first section is a focusing element comprising a plurality of facets.

7. The optical panel of claim 2 or claim 3, wherein said first section is planar facet.

8. The optical panel of claim 2, where the length of said second section controls the thickness of said optical panel.

9. The optical panel of claim 2 or claim 3, wherein the focusing power of said first section controls the thickness of said optical panel.

10. The optical panel of claim 2, wherein said third section is a folding and focusing element.

11. The optical panel of claim 2, wherein said third section is a folding and focusing element comprising at least one curved element.

12. The optical panel of claim 2, wherein said third section is a folding and focusing element comprising a plurality of facets.

13. The optical panel of claim 2, wherein said third section is a folding planar facet.

14. The optical panel of claim 2, wherein said third section is coated to enhance the total internal reflection effect.

15. The optical panel of claim 2, wherein said fourth section is a single or a plurality of transparent facets.

16. The optical panel of claim 2, wherein said fourth section is a single or a plurality of absorbing facets

17. The optical panel of claim 3, comprising a front face opposite to said back face, said front face comprising;
black barriers for absorbing light, and
transparent intervals between said black barriers for transmitting the redirected light reflected by said third section

18. The optical panel of claim 2 including an additional element or elements between said periodic structures of claim 1 to produce a non-periodic structure.

19. The optical panel of claim 3, wherein said first section is a planar facet and said second section is focusing element.

20. The optical panel of claim 2 or claim 3, where the focusing power of said first section controls the thickness of said optical panel.

21. The optical panel of claim 3, wherein said second section is a folding and focusing element.

22. The optical panel of claim 3, wherein said second section is a folding and focusing element comprising at least one curved element.

23. The optical panel of claim 3, wherein said second section is a folding and focusing element comprising a plurality of facets.

24. The optical panel of claim 3, wherein said second section is a folding planar facet.

25. The optical panel of claim 3, wherein said second section is coated to enhance the total internal reflection effect.

26. The optical panel of claim 3, wherein said third section is a single or a plurality of transparent facets.

27. The optical panel of claim 3, wherein said third section is a single or a plurality of absorbing facets.

28. The optical panel of claim 3, comprises a front face opposite to said back face comprising;
black barriers for absorbing light, and
transparent intervals between said black barriers for transmitting the redirected light reflected by said second section

29. The optical panel of claim 17 or claim 28, wherein said black barrier comprises paint.

30. The optical panel of claim 17 or claim 28, wherein said black barrier comprises black coating.

31. The optical panel of claim 2 or claim 3, wherein said transparent intervals comprise an array of cylindrical lenses.

32. The optical panel of claim 31 wherein said cylindrical lenses are arranged to increase the horizontal angle of view.

33. A rear projection video system incorporating an optical panel according to any preceding claim

34. A rear projection video system according to claim 33, further comprising at least one light generation system.

35. A rear projection video system according to claim 34, wherein said light generation system includes:
a single light source or a plurality of light sources; and
a Digital Signal Processing unit for reduction of keystone-type distortion of the image.

36. A rear projection video system according to claim 34, wherein said light generation system includes:
a single light source or a plurality of light sources; and an anamorphic optical element for reducing keystone-type distortion of the image.

37. A rear projection video system according to claim 34, wherein said light generation system includes:
a single light source or a plurality of light sources; and a
hybrid optical/digital element or elements for reduction of keystone-type distortion of the image

38. A rear projection video system according to claim 35 or claim 36, wherein the light generation system includes a light source for producing the light, and a modulator for modulating the light to form an image.

39. A rear projection video system according to claim 35,36 or 37, wherein the light source comprises a source selected from the group consisting of Liquid Crystal Display (LCD), a Digital Micromirror Device (DMD), a laser-raster scanner, a Microelectromechanical System (MEMS), a Cathode Ray Tube (CRT), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED), or Grating Light Valve (GLV).

40. A rear projection video system according to any of claims 34, 35, 36 or 37, wherein the light generation system includes image optics for distributing the light horizontally and vertically.

41. A rear projection video system according to claim 41, wherein the image optics include focusing lenses and mirrors.

42. A rear projection video system according to claim 41, wherein the image optics comprise expansion optics.

43. A rear projection video system according to claim 34, wherein there is a multiplicity of light generation systems to provide light, preferably up to, and including, four systems.

44. A rear projection video system according to claim 40, further comprising a cuboid housing having enclosing said light generation system, associated imaging optics, associated electronics and said optical panel as front face for displaying the image.

45. A rear projection video system according to claim 19 wherein said optical panel is a panel according to claim 3 and said first section is a planar facet and substantially perpendicular to the rays of said light.

Alternative set of Claims

1. An optical panel for displaying projected light formed by a primary source arranged behind the optical panel, wherein the said optical panel comprises:

a back face having a transparent, substantially periodic structure constituted of a group of transparent facets;

a transparent first section for transmitting the said light, and

a transparent second section adjoining said first section and substantially parallel to said light, and

a transparent third section adjoining said second section for effecting total internal reflection of said transmitted light situated between said first section and said second section and said third section, and

a fourth section adjoining said third section to the adjacent said first section.

2. The optical display panel claimed in claim 1, further comprising at least one light generation system.

3. The optical display panel of claim 2, wherein said light generation system includes:

a single light source or a plurality of light sources; and

a Digital Signal Processing unit for reduction of keystone-type distortion of the image.

4. The optical display panel of claim 2, wherein said light generation system includes:

a single light source or a plurality of light sources; and

Anamorphic optical element for reducing keystone-type distortion of the image.

5. The optical display panel of claim 2, wherein said light generation system includes:

a single light source or a plurality of light sources; and hybrid optical/Digital element or elements for reduction of keystone-type distortion of the image

6. The optical panel of claim 3, wherein the light generation system includes a light source for producing the light, and a modulator for modulating the light to form an image.

7. The optical panel of claim 3, wherein the light source is selected amongst the group consisting of Liquid Crystal Display (LCD), a Digital Micromirror Device (DMD), a laser-raster scanner, a Microelectromechanical System (MEMS), a Cathode Ray Tube (CRT), a single or an array of Light Emitting Diodes (LEDs), Organic Light Emitting Diode (OLED), or Grating Light Valve (GLV).

8. The optical panel of claim 3, wherein the light source comprises, but is not limited to, sources in claim 7

9. The optical panel of claim 4, wherein the light source is selected amongst the group consisting of Liquid Crystal Display (LCD), a Digital Micromirror Device (DMD), a laser-raster scanner, a Microelectromechanical System (MEMS), a Cathode Ray Tube (CRT), a single or an array of Light Emitting Diodes (LEDs), Organic Light Emitting Diode (OLED), or Grating Light Valve (GLV).

10. The optical panel of claim 5, wherein the light source is selected amongst the group consisting of Liquid Crystal Display (LCD), a Digital Micromirror Device (DMD), a laser-raster scanner, a Microelectromechanical System (MEMS), a Cathode Ray Tube (CRT), a single or an array of Light Emitting Diodes (LEDs), Organic Light Emitting Diode (OLED), or Grating Light Valve (GLV).

11. The optical panel of claim 4, wherein the light generation system includes a light source for producing the light, a modulator for modulating the light.

12. The optical panel of claim 5, wherein the light generation system includes a light source for producing the light, and a modulator for modulating the light to form an image.

13. The optical panel of claims 3, 4, and 5, wherein the light generation system includes image optics for distributing the light horizontally and vertically.

14. The optical panel of claim 13, wherein the image optics include focusing lenses and mirrors.

15. The optical panel of claim 14, wherein the image optics comprise expansion optics.

16. The optical panel of claim 2, wherein there is a multiplicity of light generation systems to provide light, preferably up to, and including, four systems.

17. The optical panel of claim 2, further comprising a cuboid housing having enclosing said light generation system, associated imaging optics, associated electronics and associated optical panel as front face for displaying the image.

18. The optical panel of claim 1, wherein said first section is a focusing element.

19. The optical panel of claim 1, wherein said first section is a focusing element comprising at least one curved facet.

20. The optical panel of claim 1, wherein said first section is a focusing element comprising a plurality of facets.

21. The optical panel of claim 1, wherein said first section is planar facet.

22. The optical panel of claim 1, wherein said first section is a planar facet and substantially perpendicular to the rays of said light image.

23. The optical panel of claim 1, wherein said second section is a planar facet and substantially parallel to the rays of said light image.

24. The optical panel of claim 1, where the length of said second section controls the thickness of said optical panel.

25. The optical panel of claim 1, where the focusing power of said first section controls the thickness of said optical panel.

26. The optical panel of claim 1, wherein said third section is a folding and focusing element.

27. The optical panel of claim 1, wherein said third section is a folding and focusing element comprising at least one curved element.

28. The optical panel of claim 1, wherein said third section is a folding and focusing element comprising a plurality of facets.

29. The optical panel of claim 1, wherein said third section is a folding planar facet.

30. The optical panel of claim 1, wherein said third section is coated to enhance the total internal reflection effect.

31. The optical panel of claim 1, wherein said fourth section is a single or a plurality of transparent facets.

32. The optical panel of claim 1, wherein said fourth section is a single or a plurality of absorbing facets

33. The optical panel of claim 1, comprises a front face opposite to said back face comprising;

black barriers for absorbing light, and

transparent intervals between said black barriers for transmitting the redirected light reflected by said third section

34. The optical panel of claim 33, wherein said black barrier comprises paint.

35. The optical panel of claim 33, wherein said black barrier comprises black coating.

36. The optical panel of claim 33, wherein said transparent intervals comprise an array of cylindrical lenses.

37. The cylindrical lenses of claim 36 increase the horizontal angle of view.

38. The, optical panel of claim 1 has an additional element between said periodic structures of claim 1 to produce a non-periodic structure.

39. An optical panel for displaying a projected light formed by a primary source arranged behind the optical panel, which optical panel comprising:

a back face having a transparent substantially periodic structure constituted by a group of transparent facets;

a transparent first section for transmitting the said light, and

a transparent Second section adjoining said first section for effecting total internal reflection of said transmitted light situated between said first section and said second section, and

a third section adjoining said second section to the adjacent said first section.

40. The optical display panel claimed in claim **39**, further comprising at least one light generation system.

41. The optical display panel of claim **40**, wherein said light generation system includes:

a single light source or a plurality of light sources; and

a Digital Signal Processing unit for reduction of keystone-type distortion of the image.

42. The optical display panel of claim **40**, wherein said light generation system includes:

a single light source or a plurality of light sources; and

Anamorphic optical element for reducing keystone-type distortion of the image.

43. The optical display panel of claim **40**, wherein said light generation system includes:

a single light source or a plurality of light sources; and hybrid optical/Digital element or elements for reduction of keystone-type distortion of the image

44. The optical panel of claim **41**, wherein the light generation system includes a light source for producing the light, and a modulator for modulating the light to form an image.

45. The optical panel of claim **41**, wherein the light source is selected amongst the group consisting of Liquid Crystal Display (LCD), a Digital Micromirror Device (DMD), a laser-raster scanner, a Microelectromechanical System (MEMS), a Cathode Ray Tube (CRT), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED), or Grating Light Valve (GLV).

46. The optical panel of claim **41**, wherein the light source comprises, but is not limited to, sources in claim **45**

47. The optical panel of claim **42**, wherein the light source is selected amongst the group consisting of Liquid Crystal Display (LCD), a Digital Micromirror Device (DMD), a laser-raster scanner, a Microelectromechanical System (MEMS), a Cathode Ray Tube (CRT), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED), or Grating Light Valve (GLV).

48. The optical panel of claim **43**, wherein the light source is selected amongst the group consisting of Liquid Crystal Display (LCD), a Digital Micromirror Device (DMD), a laser-raster scanner, a Microelectromechanical System (MEMS), a Cathode Ray Tube (CRT), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED), or Grating Light Valve (GLV).

49. The optical panel of claim **42,** wherein the light generation system includes a light source for producing the light, a modulator for modulating the light.

50. The optical panel of claim **43**, wherein the light generation system includes a light source for producing the light, and a modulator for modulating the light to form an image.

51. The optical panel of claims **41, 42,** and **43**, wherein the light generation system includes image optics for distributing the light horizontally and vertically.

52. The optical panel of claim **51**, wherein the image optics include focusing lenses and mirrors.

53. The optical panel of claim **52**, wherein the image optics comprise expansion optics.

54. The optical panel of claim **40**, wherein there is a multiplicity of light generation systems to provide light, preferably up to, and including, four systems.

55. The optical panel of claim **40**, further comprising a cuboid housing having enclosing said light generation system, associated imaging optics, associated electronics and associated optical panel as front face for displaying the image.

56. The optical panel of claim **39**, wherein said first section is a focusing element.

57. The optical panel of claim **39**, wherein said first section is a focusing element comprising at least one curved facet.

58. The optical panel of claim **39**, wherein said first section is a focusing element comprising a plurality of facets.

59. The optical panel of claim 39, wherein said first section is a planar facet and said second section is focusing element.

60. The optical panel of claim 59, wherein said first section is a planar facet and substantially perpendicular to the rays of said light.

61. The optical panel of claim 39, where the focusing power of said first section controls the thickness of said optical panel.

62. The optical panel of claim 39, wherein said second section is a folding and focusing element.

63. The optical panel of claim 39, wherein said second section is a folding and focusing element comprising at least one curved element.

64. The optical panel of claim 39, wherein said second section is a folding and focusing element comprising a plurality of facets.

65. The optical panel of claim 39, wherein said second section is a folding planar facet.

66. The optical panel of claim 39, wherein said second section is coated to enhance the total internal reflection effect.

67. The optical panel of claim 39, wherein said third section is a single or a plurality of transparent facets.

68. The optical panel of claim 39, wherein said third section is a single or a plurality of absorbing facets.

69. The optical panel of claim 39, comprises a front face opposite to said back face comprising;

black barriers for absorbing light, and

transparent intervals between said black barriers for transmitting the redirected light reflected by said third section

70. The optical panel of claim **69**, wherein said black barrier comprises paint.

71. The optical panel of claim **69**, wherein said black barrier comprises black coating.

72. The optical panel of claim **39**, wherein said transparent intervals comprise an array of cylindrical lenses.

73. The cylindrical lenses of claim **72** increase the horizontal angle of view.

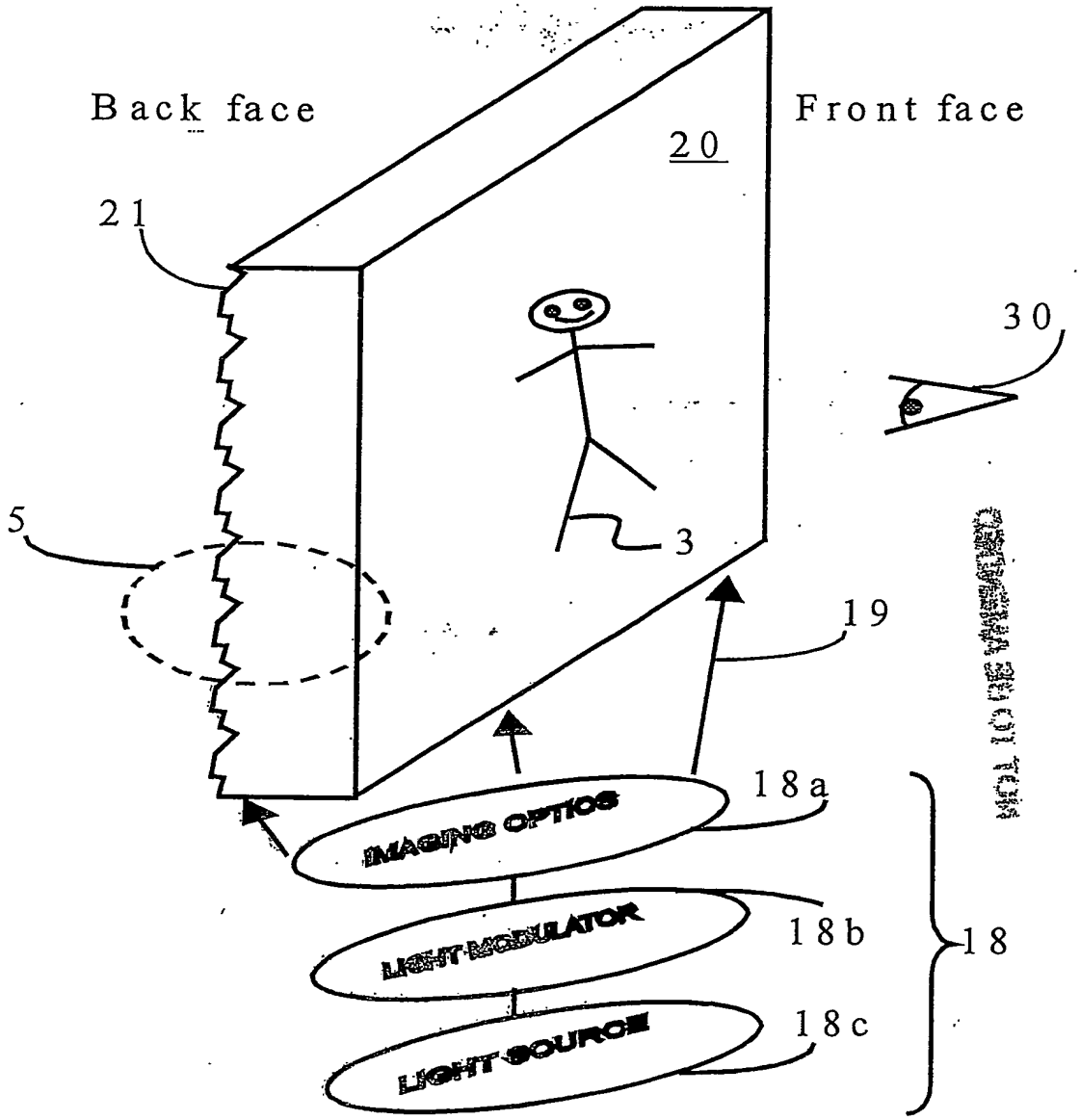
Back face
Front face
20
21
30
5
3
19
18a
IMAGING OPTICS
18b
LIGHT MODULATOR
18
18c
LIGHT SOURCE

Figure 1

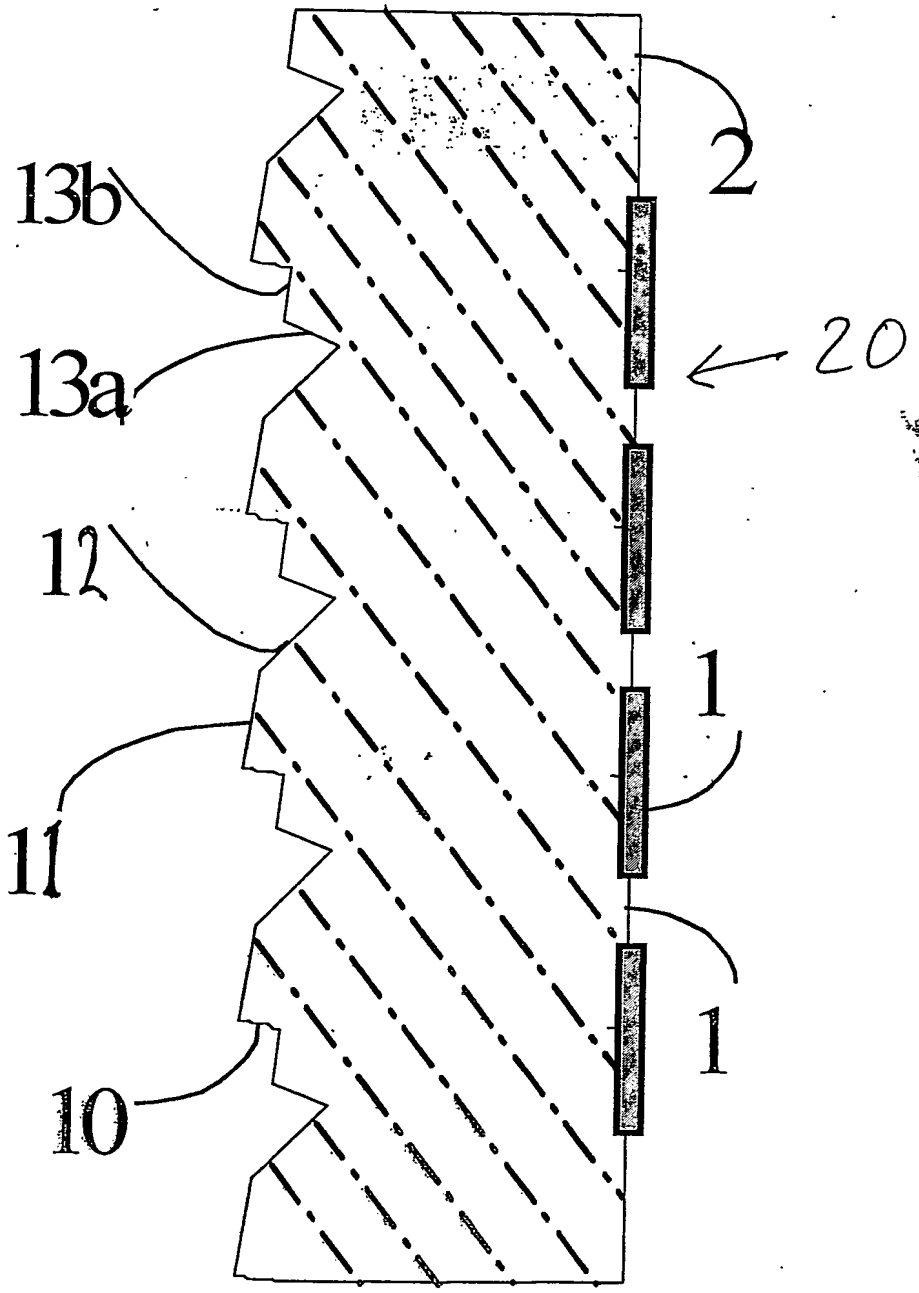

Figure 2

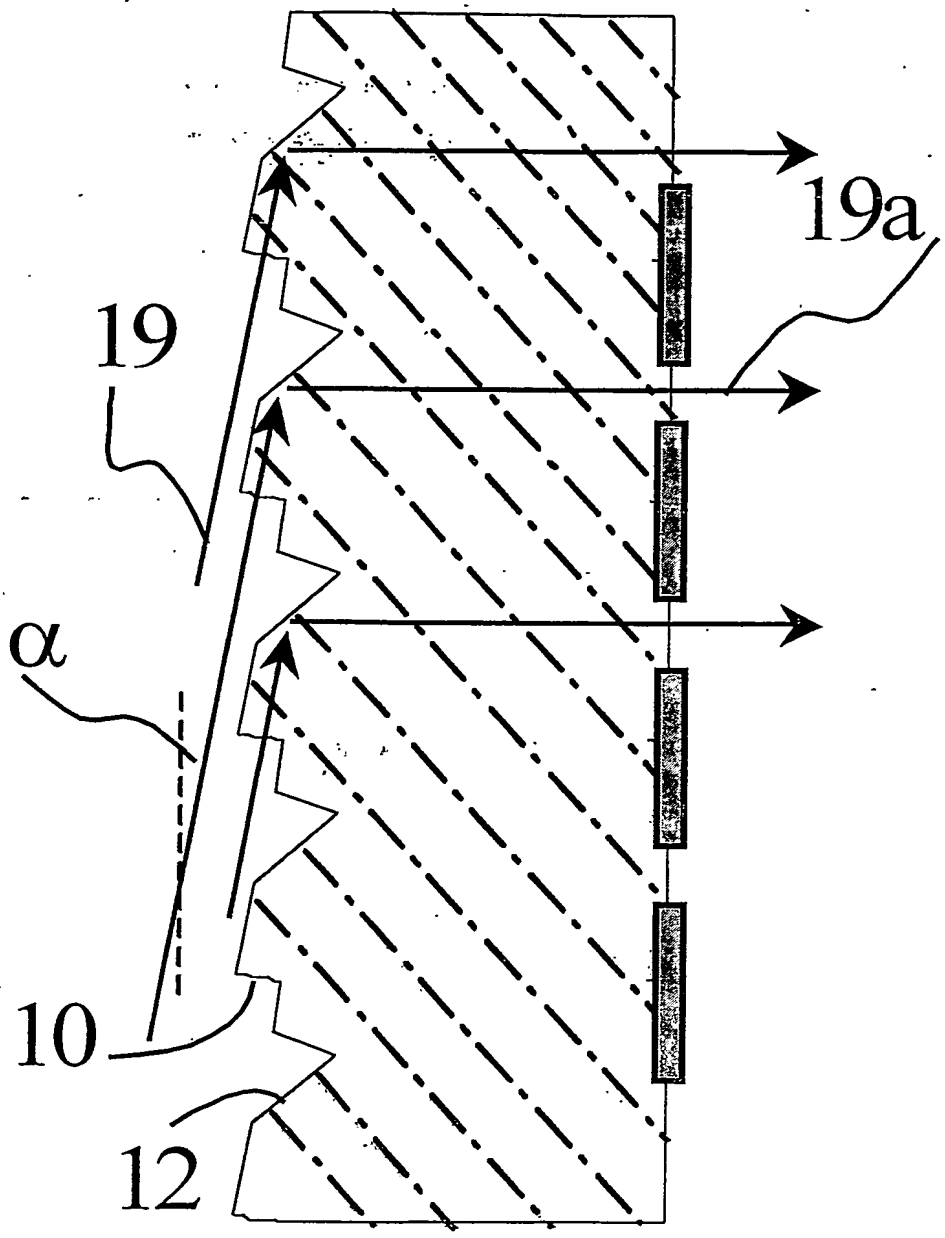

Figure 3

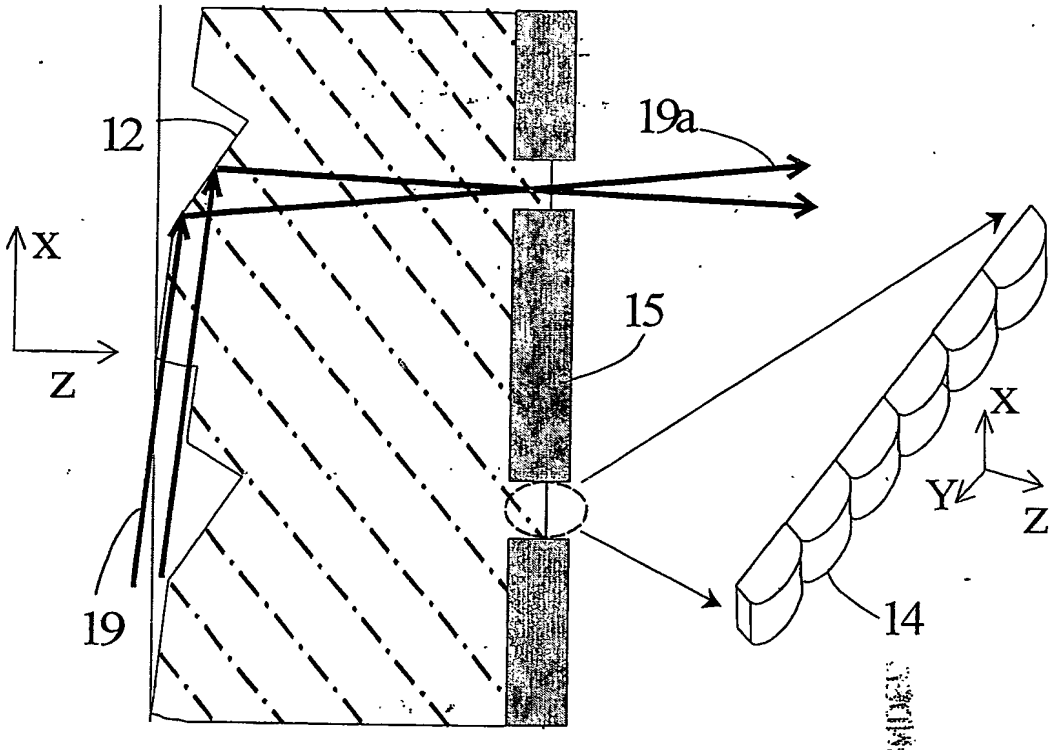

Figure 4

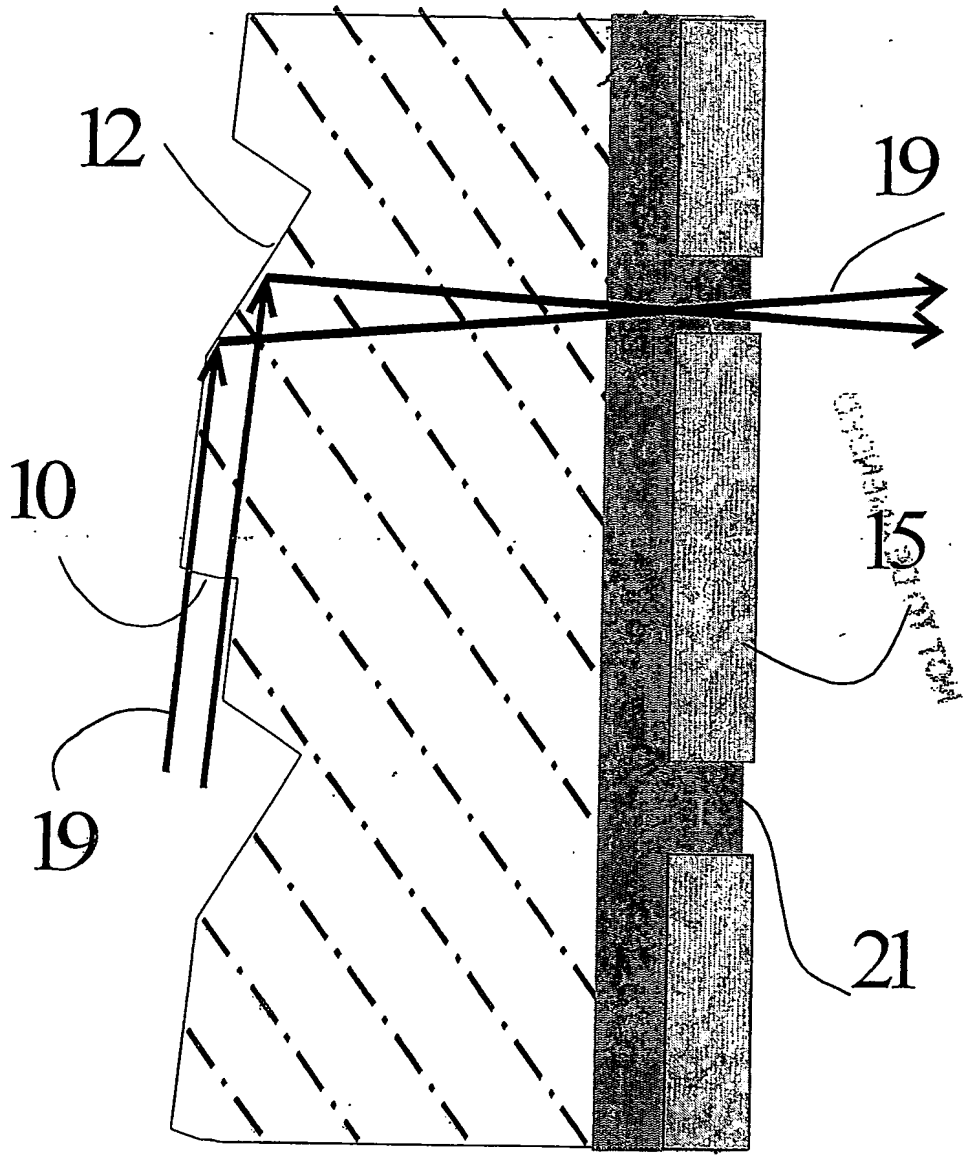

Figure 6

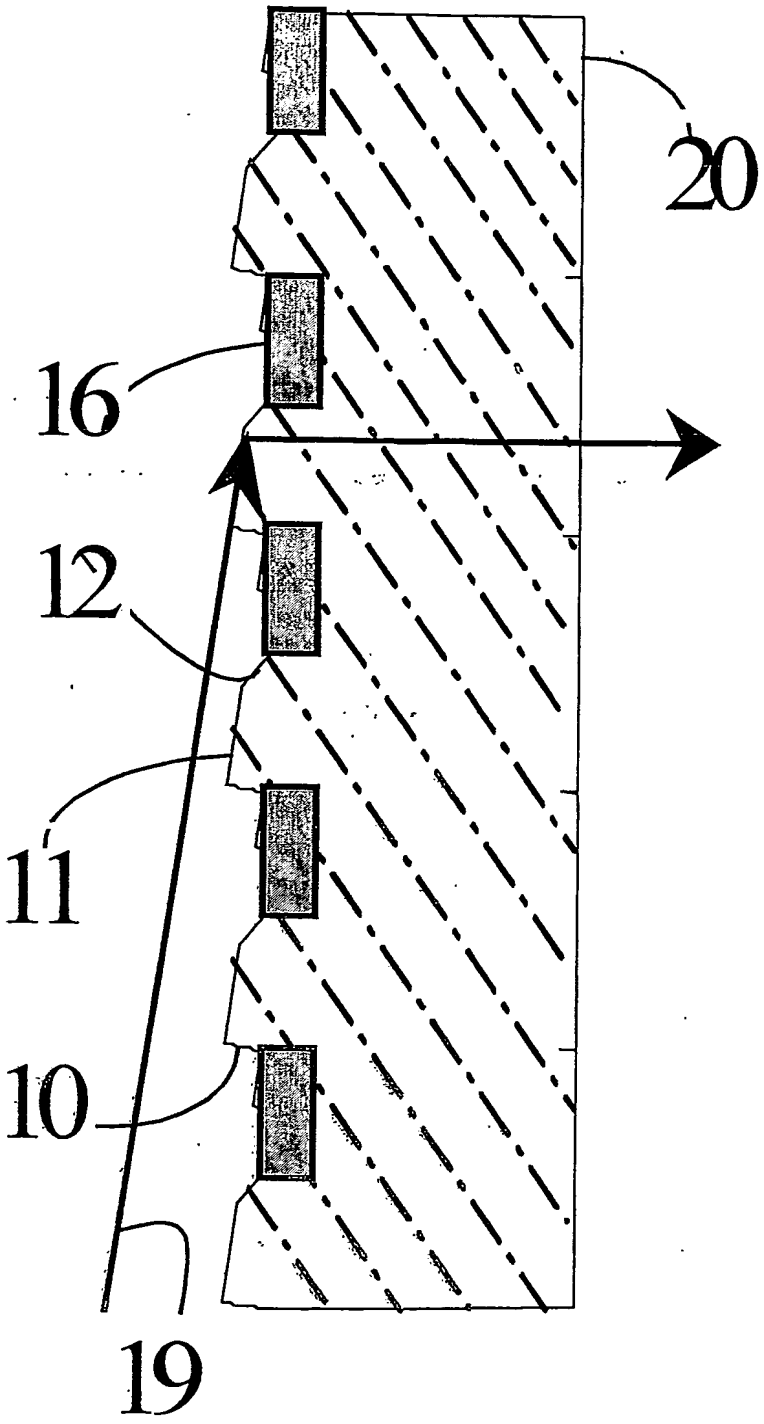

Figure 7

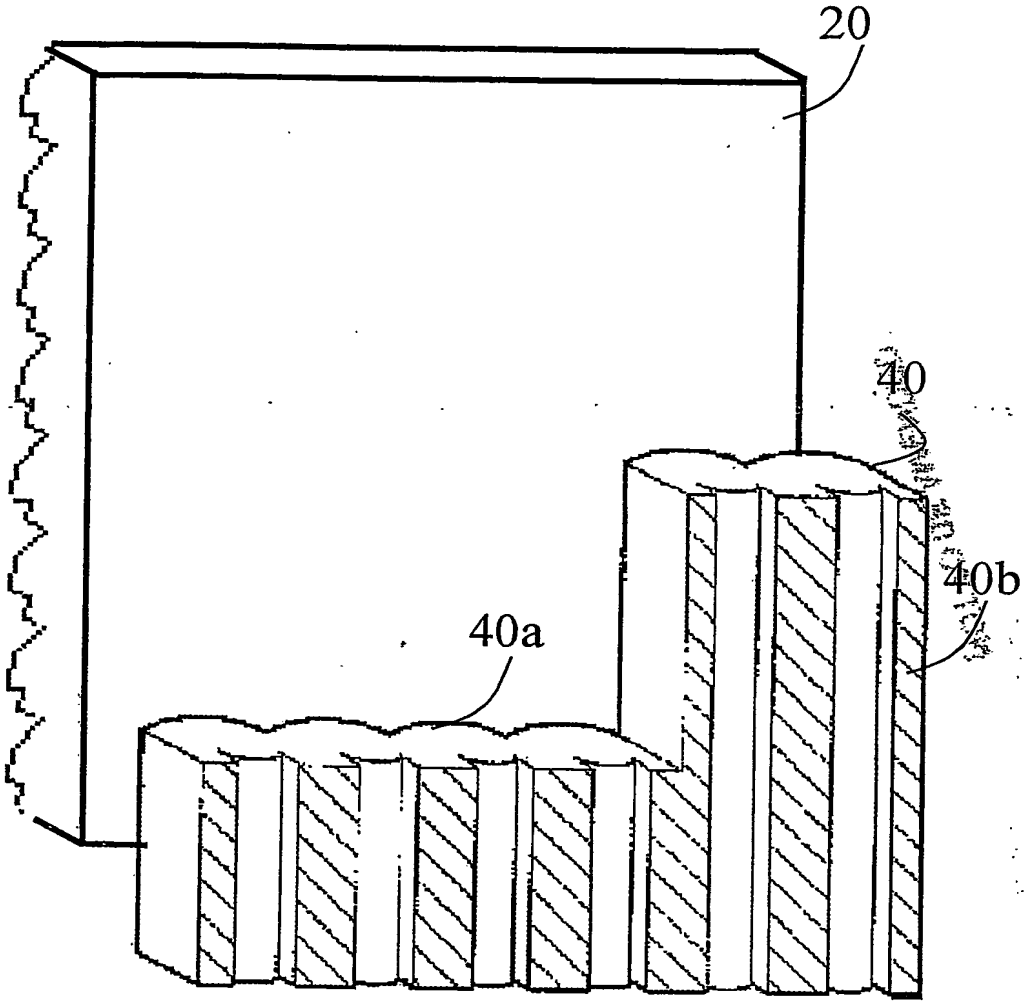

Figure 8

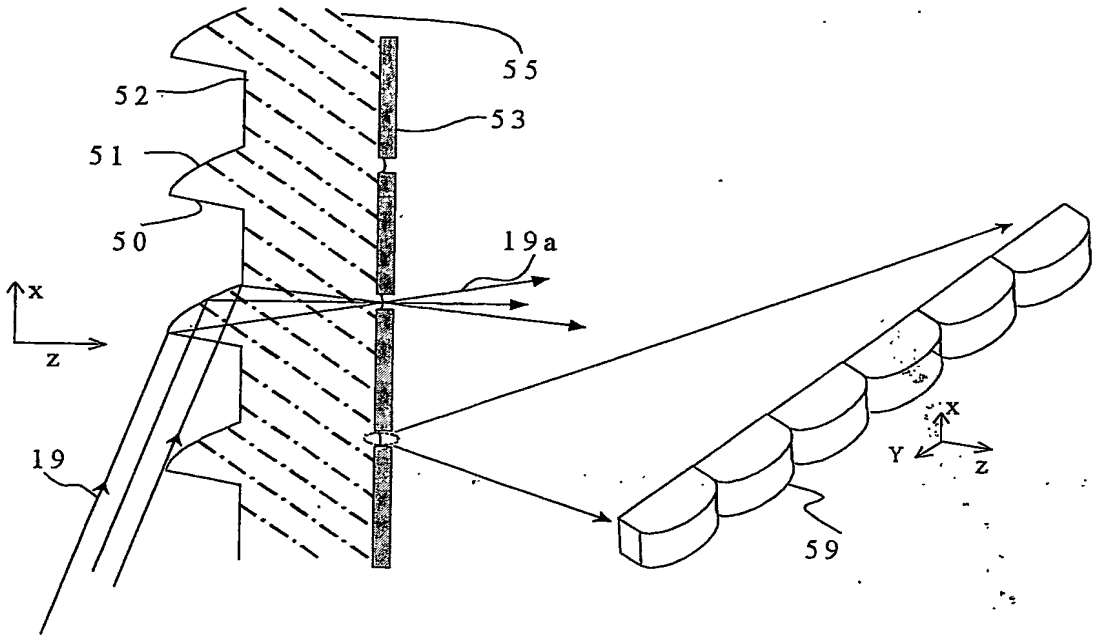

Figure 9

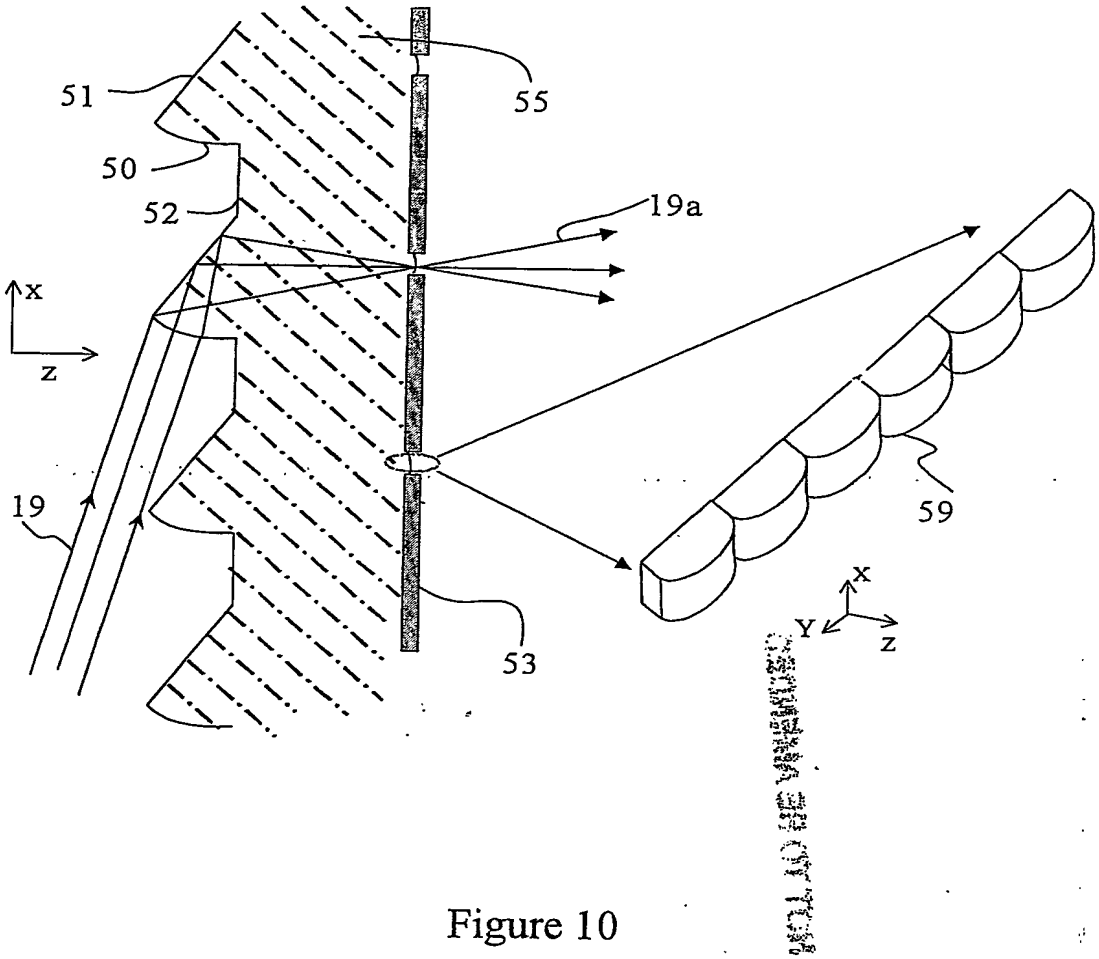

Figure 10

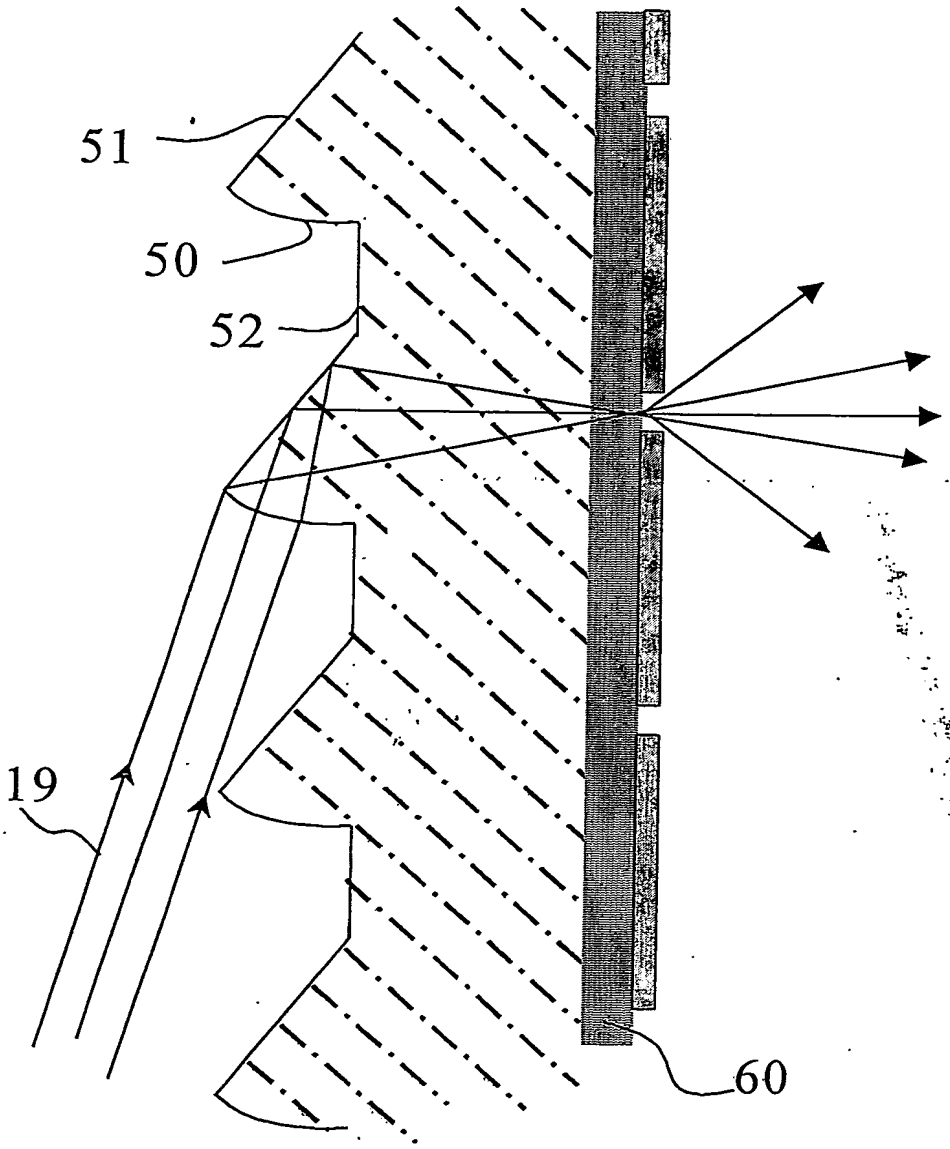

Figure 11

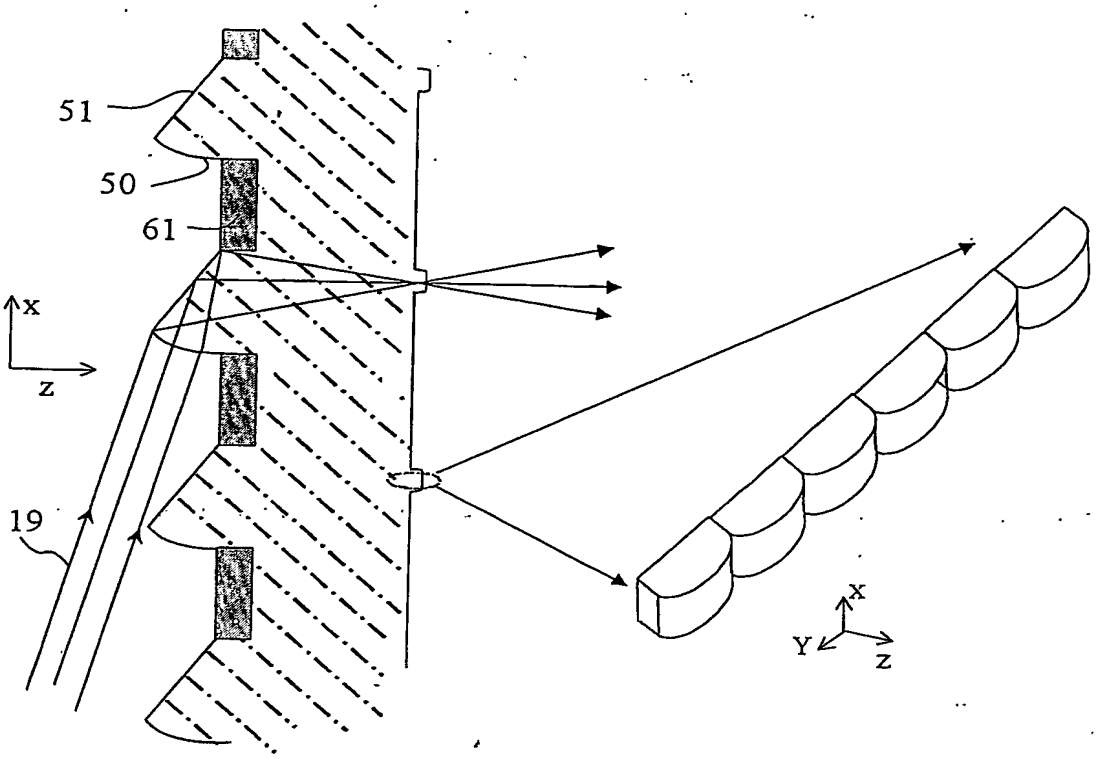

Figure 12

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